On the Nervous Circle which connects the voluntary Muscles with the Brain. *By* Charles Bell, *Esq.* *Communicated by the President, January* 25, 1826. Read February 16, 1826. [*Phil. Trans.* 1826, Part II. *p.* 163.]

The author's object in this communication is to show that every muscle is supplied with two nerves of different properties, and that where nerves of different functions have a separate origin, and run a different course, two nerves must unite in the muscle in order to perfect the relation betwixt the brain and those muscles.

Referring to his former observations, Mr. Bell remarks, that when he had distinguished two classes of nerves going to the face, and had deprived the muscles of motion by dividing the nerve, a question naturally suggested itself as to the use of the remaining nerves, more especially on finding that the 5th pair, or *sensitive* nerve, was more profusely distributed to the muscles than to the skin, although they are found in surgical operations by no means to possess that exquisite sensibility which such abundance of nerves would appear to indicate.

The lower maxillary nerve, which is a branch of the fifth pair, is composed of a nerve of sensation and a nerve of motion, arising in two sorts, one the sensitive, the other the muscular. On the former division the Gasserian ganglion is formed, but the motive nerve may be traced clear of the ganglion to the muscles of the jaws. Now if all that is necessary to the action of a muscle be a nerve to excite contraction, these branches, says the author, should have been unaccompanied; but, on the contrary, they are joined before they enter the muscles by the sensitive nerves of the ganglion.

These and similar facts and observations lead Mr. Bell to ask why nerves of sensation are thus profusely given in addition to their motive nerves; and in the progress of this inquiry, he shows that a consciousness of the state and degree of action of the muscles is necessary to the governance of the muscular frame; that motive nerves are not those by which such information is conveyed to the brain, for they are concerned in carrying the influence of the will to the muscle; and it is not likely that the same nerve should be active in two directions at the same moment; for, without reference to the cause, a simple nerve has the influence propagated along it in one direction only, and cannot be shown to act both from and to the sensorium, as may be proved by actual experience, and in illustration of which, Mr. Bell refers to the effects of sundry nerves, and to certain cases of their morbid affections.

The author, therefore, concludes that between the brain and muscles there is a circle of nerves, that one nerve conveys the influence of the brain to the muscle, and that another gives the sense of the condition of the muscle to the brain. If this circle be broken by the division of the motive nerve, motion ceases; if it be broken by the division of the other nerve, there is no longer a sense of the condition of the muscle, and therefore no regulation of it actively.

Mr. Bell concludes this paper with some remarks upon the use of the plexus formed on both sets of nerves, and on their association upon the integuments. In regard to the plexuses, he considers them as concerned in associating the functions of distinct muscles; and in reference to the surface of the body, he remarks, that although the principal office of its nerves is to convey impressions to the sensorium, yet, on the other hand, the condition of the mind is often forcibly communicated to the skin. Hence the striking union of the branches of the fifth pair with the portio dura of the seventh pair in the integuments of the head and face.

On the Constitution of the Atmosphere. *By* John Dalton, *Esq. F.R.S. &c. Communicated January* 12, 1826. Read February 24, 1826. [*Phil. Trans.* 1826, Part II. *p.* 174.]

The object of this paper is to examine the consequences as respects the proportion of the component parts of the atmosphere simultaneously existing at different heights in one vertical column, which would follow from the atomic theory, on the supposition of a finite number of atoms existing in corporeal bodies, and of such a law of repulsion prevailing among those of elastic fluids, as Sir Isaac Newton appears to have supposed, in which the repulsive power of each particle terminates at the particles immediately adjacent. It is well known that when two or more mutually inactive gaseous fluids are mixed, each distributes itself uniformly through the whole space occupied, and each sustains a part of the whole pressure retaining them, proportioned to its density. This is a necessary consequence of the mutual inelasticity and independence of the gaseous atmospheres with respect to each other. Each exerts the whole mechanical force its quantity will allow, without regard to the others; and the sum of all these forces in the state of equilibrium counterbalances the total pressure.

This uniformity of density, however, is only a consequence of the assumed principle, where the gases occupy such small spaces as we can command in our experiments, in which the total pressure may be regarded as uniform, in a vertical as well as in a horizontal direction; it is otherwise when we regard a column of indefinite height, or one prolonged to the limit of the atmosphere,—a limit at which the weight of a single particle is in exact equilibrio with the repulsion between two contiguous ones. It is this case which the author considers in the paper before us. He supposes, for simplicity, two atmospheric columns, one of hydrogen, and the other of carbonic acid, each supporting at its base a pressure of 30 inches of mercury; of such height as to reach to the respective limits of each atmosphere, divided each by partitions into cells of equal magnitude, at first insulated from each other, then made to communicate, and finally, the cells to be withdrawn, and a free communication established between every part of the two columns: and from an analysis of what passes in the act of communication, and from the general principles